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REVIEWS.

A New Text-Book on Hydraulics, A New Theory of Water Flow, and Some Diagrams.

Reviewed by GARDNER S. WILLIAMS,* M. Am. Soc. C. E.

TEXT-BOOK ON HYDRAULICS.—By George E. Russell, Assistant Professor of Civil Engineering, Massachusetts Institute of Technology. New York: Henry Holt & Co. Cloth; 6 × 9½ ins.; pp. 183; 124 illustrations in the text. $2.50.

THE FLOW OF WATER.—A New Theory of the Motion of Water under Pressure and in Open Conduits and Its Practical Application. By Louis Schmeer, Civil and Irrigation Engineer. New York: D. Van Nostrand Co. Cloth; 6 × 9¼ ins.; pp. 228; text illustrations and tables. $3, net.

HYDRAULIC DIAGRAMS.—According to Kutter's Formula. Diagrams 1 and 2, Showing Capacity of Circular Conduits; Diagram 3, Showing Capacity of Egg-Shaped Conduits; Diagram 4, Showing Capacity of Egg-Shaped Conduits with Flat Top. Computed and Drawn by A. A. Brown and A. C. Toll. San Francisco, Cal.: The Authors (20 Parkside Ave.). Separate sheets; 24¼ × 16 ins. $1 per sheet; $3 per set.

In his "Text-Book on Hydraulics," Prof. Russell very correctly calls attention in his preface to the fact that a book designed primarily for the class room should be different from one for the practicing engineer.

Class room use requires essentially, and it may be said solely, a clear and concise presentation of the fundamental principles of the subject treated, without the enumeration of specific examples or possible applications, which latter are to be supplied by the instructor, and the final advantage of the course must depend to a very large degree upon that instructor's personality and experience. On the other hand, the book for the professional man may properly assume a fundamental knowledge of the underlying principles, but must contain such examples and applications as will supply the place of the instructor. With a book of the former type and an indifferent instructor the student may carry away little of knowledge that will be of future assistance, and his text-book as a work of reference will be almost valueless, bearing to such a requirement about the same relation that a spelling book does to a dictionary. Under such conditions a more complete treatment would undoubtedly be better for the student, but such conditions should not, though it must be recognized they frequently do, exist. In its use for reference there is an advantage in a thorough familiarity with the content of the book in question, and such familiarity is rarely acquired so well as through its study as a text-book. From this standpoint a good argument may be presented for the more complete work.

The advantage or disadvantage of the use of one or the other type in class-room instruction must, however, finally depend upon the character of the instructor and the previous training of the student.

The work in question belongs in the class adapted to students of slight preparation who require a well-trained and able instructor. It is the result of the experience of instructors in teaching students of varied qualifications who desire a treatment of the subject varied in its thoroughness.

The book makes no attempt to deal with hydraulic machinery, and follows in general plan the scheme of Part IV. of Church's Mechanics, but as the author started afresh it was possible to improve the arrangement somewhat and to include in their natural order some subjects which in the older work have been inter-paragraphed without always being strictly germane to the context.

At the end of several of the chapters is presented a brief bibliography of the principal subjects treated, and a few problems are given indicative of the type to which the preceding discussions are applicable. The work starts with the usual introduction covering definitions, physical properties and units. This is followed by Chapter II., devoted to Hydrostatics, where the fundamental concepts and derived conditions are very clearly presented. The differential calculus is used freely in the discussion, though the resulting expressions are all quite simple and should give no trouble to any student having an elementary knowledge of that branch of mathematics. Translation and rotation effects are treated in Chapter III. somewhat less extensively than in Church, but with clearness and completeness so far as the fundamentals are concerned. The treatment of Bernoulli's Theorem, which makes Chapter IV., while not the rigid one of Gibson is that usually given in American text-books and in the analysis the author shows his familiarity with the difficulties of the ordinary student. Chapter V. deals with the "Discharge from Orifices," and is followed in Chapter VI. by "Flow through Mouthpieces," from which Borda's mouthpiece is unfortunately omitted. While this apparatus is not particularly important in itself, it affords altogether the best opportunity to confirm theory by experiment, as well as calling attention to the effect of a re-entrant mouthpiece. Chapter VII. is devoted to "Flow over Weirs" where the formulas of Francis, Fteley and Stearns, Bazin and Hamilton Smith, Jr., are discussed, as well as submerged weirs and triangular notches, and a brief mention is given to the subject of irregular weirs, to which latter reference is made in the bibliography. "Flow through Pipes" is the subject of Chapter VIII. Whether a formula involving the second power of v with a variable coefficient, or a fractional power with a constant coefficient, is to be preferred is a matter of taste, and the desired accuracy of the computation made without reference to a table of coefficients. The author along with many of the older writers adopts the former and presents the usual table showing that the so-called constant coefficient f in the well-known formula $h = 4f \frac{l}{d} \frac{v^2}{2g}$ varies in the same pipe for velocities from 10 to 0.5 ft., over 60%, and for the same velocity, in pipes from 72 to 3 ins. in diameter, more than 180%. For the one who must depend upon memory for his formula, the other type would seem to involve the less effort, and a comparison of experiments between the mean formula

$$H_l = \frac{K v^{1.86}}{d^{1.25}} \frac{l}{1000},$$

and the older form will show a decided advantage in accuracy for the exponential type, a fact that appears to have escaped the author's notice. In discussing the distribution of velocities in pipes, the old Darcy parabola is resurrected; that it was determined from only five points, none of which were appreciably nearer the wall than one-third the radius, being overlooked. As a matter of fact there is nothing in the work of Darcy inconsistent with the more recent results which show the curve to be nearly tangent to the pipe wall, and it is unfortunate that the older but erroneous conception should be perpetuated in a book containing so many admirable features, even though the more accurate results are also given.

Chapter IX. deals with open channels and might be highly commended were it not for the author's endorsement of Kutter's formula as being the best yet devised. If the results obtained by this formula be compared with experiment it will be found to be one of the worst, for according to it the roughness of a channel changes with the velocity in it and no one can use it safely for either velocities or diameters 25% beyond the range of actual experiment, and yet by the extreme complication of it the inexperienced are led to believe it entitled to credit for a high degree of accuracy. Some space is devoted to the useless back-water expressions, only applicable to channels of uniform width which almost never occur in practice where the back-water problem is encountered. In concluding the chapter the author wisely refuses to countenance any formula for the flow in natural channels. Chapter X. discusses the impact of jets, water hammer and reaction at pipe bends and the book is concluded with an appendix of tables of coefficients, weights of water and velocity heads.

Taken as a whole the book is an improvement on many of its predecessors and for those looking for a text-book covering only the fundamentals, it can be very strongly recommended in spite of the few defects pointed out.

The author of "The Flow of Water" states that the work is the outcome of an endeavor to find a simple expression for the flow in irrigation canals. He begins with a brief summary of the history of hydraulic formulas, coming down as far as Bazin's work of 1898, but the developments of the past ten years are apparently as yet either unknown or unappreciated. In the beginning of the investigation the author discovers the well-known fact that the hydraulic radius is not a satisfactory factor to account for changes of form, but instead of attempting to find a factor which will define the form he involves the hydraulic radius to some five different exponents, and proceeds to deduce a formula. Although he starts with the rather odd statement that gases are viscous fluids, he nevertheless arrives at the correct conclusion of the variation of pressure across a stream. Had the investigation started with the obvious condition that the resistance to motion emanates from the wetted border and that the force producing motion is that of gravity acting on the mass of water, and an expression been written combining these conditions and a formula been derived involving this as a factor, something might be hoped for from the result; but with the necessary inaccuracies existing in all open channel work it is practically impossible to derive an accurate expression from such data, and the method of the author, which includes a factor whose relation to the result can only be expressed by the introduction of variable coefficients loaded with variable exponents, leads to a complication beyond the limits of present utility, although the resulting expressions are considerably simpler than those of the Kutter formula.

The ground covered is similar to that traversed by the late Chas. H. Tutton some fourteen years ago. A large part of the work is made up of tables of factors and tabulations of experiments from different authorities. If the former be judged by the latter they should be used with caution.

A sort of appendix to the book is devoted to the methods and apparatus used in hydraulic observation. In this the use of a brass tube for containing mercury is mentioned, the affinity of mercury for the constituents of this mixture apparently never having come to the author's at-

*Professor of Civil, Hydraulic and Sanitary Engineering, University of Michigan, Ann Arbor, Mich.

tention. The rod float is referred to as giving directly the mean velocity in the vertical of a stream and while something over two pages are devoted to float gagings the well-known Francis Float Formula is not mentioned nor is any substitute for it proposed. The Price meter is described as having four cups, and the so-called integrating method of meter gaging is recommended, although its unreliability was demonstrated both practically and theoretically several years ago. The Pitot tube is described as made of glass and the statements concerning its action are equally erroneous.

On the whole the work betrays a lack of both practical and theoretical knowledge, and while its preparation was doubtless an interesting pastime and a profitable occupation, the same cannot be said of its perusal.

A set of white-print diagrams of the discharge of circular and egg-shaped conduits has been prepared by Messrs. A. A. Brown and A. C. Toll, of San Francisco. If one is to use Kutter's formula he certainly needs a set of diagrams, but the use of diagrams made from it does not insure correct results in design, and in fact is likely to insure incorrect results except for a quite narrow range of velocity. These diagrams are not materially different from a good many others, but so long as this formula continues in use such diagrams will continue to be produced. The lettering and lining on the prints are highly creditable, the figures are fair, and the diagrams have undoubtedly been of service to their producers. They are copyrighted, but, unfortunately, the formula itself is not; were it so, less valuable time would be wasted over it.

New and Revised Edition of Johnson's Framed Structures.

Reviewed by F. C. KUNZ,* M. Am. Soc. C. E.

THE THEORY AND PRACTICE OF MODERN FRAMED STRUCTURES.—Designed for the Use of Schools and for Engineers in Professional Practice. By The Late J. B. Johnson, C. W. Bryan, Manager of The American Bridge Co., and F. E. Turneaure, Dean of the College of Mechanics and Engineering, University of Wisconsin. In Three Parts. Part I.: Stresses in Simple Structure. 9th edition, rewritten. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 6 × 9¼ ins.; pp. 328; numerous illustrations in the text. $3, net.

The ninth edition of this standard work is divided into three volumes of octavo size. The present volume, Part I., treats of Simple Structures, including beams and trusses; Part II. will treat of structures requiring higher methods of analysis, such as swing bridges, arches, suspension bridges and cantilever bridges, and will include a comprehensive treatment of secondary stresses; Part III. will be devoted to the subject of design. Parts I. and II. correspond, therefore, in a general way with Part I. of the old edition, and Part III. with Part II.

The present volume covers essentially the same ground as Chapters I. to VII., and Chapter XV. of the old edition. This material has, however, been largely rewritten and considerably expanded. It is arranged in seven chapters: (I) Definitions and Historical Development; (II) Elements of the Analysis of Framed Structures; (III) Analysis of Roof Trusses; (IV) Analysis of Bridge Trusses for Uniform Loads; (V) Analysis of Bridge Trusses for Concentrated Loads; (VI) Lateral Trusses, Trestles and Towers; (VII) Deflection of Structures and Stresses in Redundant Members.

The plan originally adopted of carrying the graphical and algebraic methods along together has been adhered to, though more attention is given to the graphical methods than in the former editions, conforming to the commendable tendency of modern publications.

Chapter I. is unchanged; it is intended rather for the student than for the practicing engineer. For this reason it would have been advisable to change article 5, where the elastic limit is defined as the limit of proportionality between stress and strain, and point out clearly the difference between these two limits and also define the commercial elastic limit, that is, the yield point.

*Consulting Engineer, Osborne and Vicaris Sts., Wissahickon, Philadelphia, Pa.

Chapters II. and III. have been entirely revised by Mr. W. S. Kinne, Asst. Prof. in the University of Wisconsin, and are especially valuable to the student of Graphic Statics. Referring to the example on the lower half of p. 34, it would have been advisable to state clearly that the problem of finding the amount of two forces with given lines of action cannot be solved in general; the equilibrium polygon will show whether the solution is possible. A new section is added on "Centre of Gravity, Moments and Moments of Inertia." The section entitled "Application of the Laws of Equilibrium" has been considerably enlarged to great advantage. It would have helped the student if the preference of the different methods for different cases had been pointed out. The method of finding the stress in a truss by successively resolving the forces at each panel point into two unknown stresses is very instructive but is hardly ever used in practice. The first line of Article 46, p. 60, should, of course, read "To single joints to find stresses" instead of "Two single joints, etc." Why the term "Maxwell Diagrams" was left out of the present volume is not quite clear. It is true that there are many who credit Cremona with the introduction of this method. On the other hand it is very convenient to be able to designate with one word a certain method.

Chapter IV. is practically unchanged.

Chepter V. has been thoroughly revised and enlarged to great advantage, a prominent part being given to the determination of live load stresses by means of influence lines. This is the most simple and lucid method, particularly for web members of trusses, trusses of skew-bridges, bending moments of connecting pins when simultaneous stresses have to be found, etc. Two very interesting examples are given on p. 233 and 236 for the maximum tensile stress caused by the curvature of the top chord in the verticals of a single panel truss and of a subdivided truss respectively. It might be of interest to note that this method of finding tension in verticals, which to many engineers will be new, was in use in the Bridge Department of the Pencoyd Iron Works twenty years ago, and is still the best solution of this problem.

Chapter VI. (Chapter VII. of former editions) is practically unchanged.

Chapter VII. (Chapter XV. of former editions) is rearranged and improved by the addition of the graphical methods to determine the deflection of structures, also of "Maxwell's Law of Reciprocal Deflections" (perhaps more clearly expressed: "Reciprocity of Deflection and Load").

The ninth edition is decidedly an improvement on the former editions. "Modern Framed Structures" will continue to occupy a prominent place in the library of the student as well as of the practicing bridge engineer.

The two remaining volumes which are promised within a year will be awaited with great interest.

WROUGHT-PIPE DRAINAGE SYSTEMS.—By J. J. Cosgrove, Author of "Principles and Practice of Plumbing," etc. Pittsburg, Pa.; Standard Sanitary Mfg. Co. Cloth; 5½ × 8½ ins.; pp. 145; 137 illustrations in the text. $2.

The author suggests in the preface that a more descriptive name for this book would have been "The Manipulation of Wrought Pipe," inasmuch as it is of much broader scope than is implied in its title. Most of the material presented would be equally applicable to the working of iron pipe for heating systems, steam lines, etc.

The physical characteristics and properties of wrought pipe are treated in the first chapter. Then come six chapters describing the working of wrought pipe and the form and uses of the various pipe fittings. Three chapters follow on laying out, planning and installing of piping systems. Somewhat in the nature of an appendix, there are two final chapters on working polished brass and nickel-plated pipe and on pipe welding by the thermit process.

An interesting feature of the first chapter is a brief historical sketch of the Durham system of house drainage—the original wrought-pipe, recessed-fitting drainage system patented in 1880, by Caleb W. Durham. Mr. Durham's recent death was recorded in our issue of April 7.

This book might well be put in the hands of students at technical schools, where it would relieve instructors from the present general practice of imparting orally or by the inefficient means of catalogs such information as it contains.

PATTERN-MAKING.—By G. H. Willard. To Which Are Added Chapters on Core-Making and Molding, by F. D. Crawshaw, Assistant Dean, College of Engineering, University of Illinois. Chicago, Ill.: Popular Mechanics Co. Cloth; 5½ × 8¼ ins.; pp. 2[illegible], 27 plates, containing 312 illustrations. $1.

The first and principal part of this book, occupying more than nine-tenths of its pages, is arranged in four divisions taking up respectively introductory information, machine tools, patterns and molding. The introductory portion includes four chapters on general considerations, hand tools, woods and joints. Machine tools used by pattern makers—lathes, saws, planers and trimmers—are treated in the next eight chapters, which discuss in detail the proper uses and care of the machines. Ten chapters are devoted to careful instruction for the making of specific patterns. The patterns chosen are of gradually increasing difficulty and cover practically all the points that come up in ordinary practice. Two brief final chapters discuss molding machine work and the patterns used.

Part II describes briefly the making, baking and setting of cores, tells what they are used for and explains the uses of loam patterns and molds and the methods of making them.

Considering especially the low price of this book it is remarkably practical and comprehensive. It is written in a style much more readable and effective than is usual with books on this subject.

CEMENT IN SEAWATER.—Report on the Trials, Commenced in 1906 on the Recommendation of the Society of Scandinavian Portland Cement Manufacturers. By A. Poulsen, Resident Engineer to the Office of Harbours and Coast Protection at Lemvig, Denmark, Chairman in the Committee for Conducting the Experiments. (Presented to the Members of the International Association for Testing Materials by the Society of Scandinavian Portland Cement Manufacturers.) (London, England: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain.) Paper; 6 × 9½ ins.; pp. 59; folding plates and text illustrations. $1.25.

In April, 1906, the Scandinavian Portland Cement Manufacturers appointed a committee to undertake a series of long-time tests on the effect of sea-water on concrete and a few months later the tests were started. They were designed to cover a total period of 20 years and included the manufacturing of many thousands of specimens of concrete blocks and briquettes of different composition and the successive testing of these specimens at intervals through the 20 years, half of the specimens to be kept in normal conditions in the air and half in sea water at various places on the north coast of Europe, where weather conditions as a rule are exceptionally severe. The tests now have extended over a period of 10 years, the longest tests of sea water and concrete ever recorded, so far as we know, and the record of the experiments is set down in some detail in the book noted above. The method of reporting is not particularly clear, but on account of the scope of the tests, the record is exceptionally valuable.

SULLA COSTRUZIONE DEI MURI DI APPRODO SU FONDO FANGOSO. [The Construction of Quay Walls on Soft Ground.]—C. Barberis. Rome, Italy: Pub. Doc. (Ministero della Guerra). Paper; 8½ × 12¼ ins.; pp. 106; 33 plates.

The author of this book is a Major in the Corps of Engineers of the Italian army and has been connected for the last 20 years with the harbor works of that country. During that time he has had occasion to observe in great detail the behavior of quay walls, particularly those founded on soft or shifting bottoms such as is common in the ports of Spezia and Taranto, and from these observations has developed a style of wall which is best calculated to last under such conditions. In this wall, composed generally of masonry blocks, there are provided iron or steel rods tying the masonry back into the solid earth of the bank and so arranged that the wall can gradually sink into the bottom until it has taken a bearing and the footing soil has sufficiently compressed to take the load of the wall and the thrust from the fill without the

aid of the tie-rods which by that time have probably rusted away.

The book noted above gives in some detail the records of the movements of a number of Italian walls, summarizes the theory of such movements and describes the wall devised by the author. It is accompanied by a number of plates containing drawings and half-tones of many quay-walls which have been built in Italy. It is to be regretted that its publication in Italian only will make it unavailable to a number of American engineers, though its plates will be of interest even to those who cannot read the language.

A British Book on Structural Engineering.

Reviewed by L. E. MOORE,* Assoc. Am. Soc. C. E.

THE THEORY AND DESIGN OF STRUCTURES.—A Text-Book for the Use of Students, Draftsmen and Engineers engaged in Constructional Work. By Ewart S. Andrews, Lecturer in Theory and Design of Structures at the Goldsmiths' College, New Cross. London, England: Chapman & Hall, Ltd. Cloth; 5½ × 8¾ ins.; pp. 589; numerous plates and text illustrations. 9s., net; American price, $3.60, net.

The object of this volume is, as stated in the preface, to supply a book covering a wide ground, of reasonable price, sound in theory and yet sufficiently practical and free from advanced mathematics to make it of use to the greater number of draftsmen and engineers.

In a book of 582 pages covering as wide a field as this one does, the treatment of many of the subjects is necessarily very brief; but on the whole the author has succeeded quite well in presenting fundamental principles in a small space. The author states that the book is based on lecture-notes. This may account, to some extent, for an apparent lack of balance between different portions. For example, the theory of beams is very thoroughly developed, going into the general theory of flexure and curved beams, while the chapter on columns is exceedingly meager for such an important subject.

The first fifteen of the eighteen chapters treat of strength of materials, loads, various graphical constructions, stresses in beams, framed structures, masonry, theory of earth pressure, reinforced concrete, suspension bridges and some others of the so-called higher structures. The last three chapters treat of the design of buildings, foundations, roofs and bridges. The principles are illustrated by problems which are worked out, supplemented by 90 problems in the back of the book and an appendix giving the properties of British standard sections.

Graphical methods are freely used throughout, especially in the development of the various propositions concerning moments, shears, etc., on beams; the resulting formulas are expressed in algebraic terms. The use of these methods adds materially to clearness and brevity of treatment, particularly in the cases of fixed and continuous beams.

The theory of curved beams, too often omitted in texts written in the English language, is treated concisely and in accordance with the most generally accepted theory. The more exact theory, involving Poisson's ratio, is mentioned but not developed, as seems wise, because Poisson's ratio is not accurately known for steel and the use of the more accurate theory makes a very small percentage of difference in the stresses. This theory is extended to chains, but it should be noted that the force applied to a link is assumed concentrated at a point; whereas if it be distributed over an area there will be a considerable difference in the resulting stresses.

The subject of stresses in trusses is treated almost wholly from a graphical standpoint and no use is made either of the moment diagram or the influence line.

The chapter on reinforced concrete is almost too brief and hardly sufficiently complete for working purposes. It closes with illustrations of various types of this form of construction.

The theory of suspension bridges is developed in the customary way and the author has fallen into the common error of making the maximum moment on a stiffening truss with no center hinge and uniform live load equal $\frac{pl^2}{54}$ at the third-point instead of the correct value $\frac{pl^2}{32}$ at the center of the span.

In the chapter on design there are some things which would not be favorably regarded by an American designer. These differences between British and American designs are so generally understood that it seems scarcely necessary to call attention to any particular points. The reviewer is curious, however, to know why every one who gives birth to a formula, or even a mere statement, for determining the depth of a plate girder in terms of the span, calls his formula one for obtaining the "*economic*" depth. For instance in this book, the statement is made that the "economic depth" of a plate girder is "from 1/10 to 1/15 of the span, 1/12 often being adopted." It is scarcely necessary to remark that a girder of depth of 1/15 of its span would be a very uneconomical structure from almost any point of view.

In the chapter on loads some valuable data on wind pressures at various heights are given. There also is an interesting table of coefficients of impact which makes them dependent upon the ratio of live to dead load. This is said to be derived from a large number of deflections of bridges taken for the Indian Government.

One feature of the book that cannot be too highly commended is the incorporation, after the development of each proposition, of a statement clearly defining the limitations of the formula derived.

*Assistant Professor of Civil Engineering, Massachusetts Institute of Technology, Boston, Mass.

CIVIL ENGINEERING AS APPLIED IN CONSTRUCTION.—By Leveson Francis Vernon-Harcourt, M. Inst. C. E., Author of "Sanitary Engineering," etc. Second edition, revised by Henry Fidler, M. Inst. C. E., Author of the article on "Dockyards" in the "Encyclopedia Britannica," etc. London, New York and Bombay: Longmans, Green & Co. Cloth; 5½ × 9 ins.; pp. 626; 368 illustrations in the text. 16s., net; American price, $5.

The first editors of this book by that well-known British engineer and author, the late L. F. Vernon-Harcourt, appeared in 1902 and since that time has run through the issue. In preparing the new printing the publishers thought it wise to have it brought to date, and for that purpose called in Prof. Fidler. We have not available the first edition for purposes of comparison, but from a perusal of the book and from the reviser's preface, we would say that this revision has not been very elaborate, confining itself mostly to completing the description of works in process of construction in 1902, and not attempting any extended discussion of processes developed or structures built during the ten years that have elapsed since the book was written. Thus, although the latest project on the Panama Canal is mentioned, there is no note of the immense irrigation works now in progress in the western United States or of the huge masonry dams there being erected. Such errors as there are, then, are of omission, and hardly to be avoided in a book of so ambitious a scope.

In the preface the author gives the following outline of his scheme:

> The vast and increasing development of engineering science, and its numerous ramifications, have necessarily led to the subdivision of engineering into different branches, such as mechanical engineering, mining engineering, electrical engineering, and naval architecture, as well as civil engineering, which is more and more being employed to denote the special constructive branch of engineering as distinguished from the other four. It is, accordingly, proposed to deal in this book with civil engineering in its modern, restricted sense; and even in this limited application of the term, it comprises some distinct branches which are often regarded as more or less subdivisions of the science, such as railway, canal, river, maritime, hydraulic, and sanitary engineering, though much less distinctly separated from one another than the five branches of engineering enumerated above.

Following this idea he has devoted to materials and preliminary works, 36 pp.; to excavations and foundations, 43 pp.; to roads, 20 pp.; to railways, bridges and tunnels, 226 pp.; to rivers, canals and irrigation, 114 pp.; to docks and other maritime engineering, such as harbor work and coast protection, 72 pp.; to sanitary constructions, 56 pp.; and to a quite complete index, 57 pp. It will be seen that in this short space there can be no more than a general discussion of any one subject and that the details must be learned from specialized books. However, the work has been well done and the subjects chosen judiciously. The attempt to compress into one volume the entire subject of one of the larger branches of engineering has been made before by Patton and Fiebeger and before them, by Mahan, the last two college texts. There is undoubtedly some value in such a book in placing before a specialist in engineering the main features of those forgotten, or perhaps never learned, branches of engineering not included in his specialty, and in examining such books this useful purpose must not be forgotten. They cannot be used as texts to cover the subject completely, but they may be very necessary in affording an easy means of obtaining a rapid survey of some branches of the subject. To this end Vernon-Harcourt's book is successful.

At the risk of appearing hypercritical we quote from the chapter on railways the following sentence:

> An elevated railway in a street is somewhat of a nuisance, even where electric traction and a watertight floor are adopted, as in Liverpool or Berlin, instead of locomotives and open flooring, causing smoke and noise, and the dropping of water and cinders on the roadway below, as in New York and Brooklyn.

Even in 1902, the transformation of the elevated railways of New York from steam to electric power was nearly completed; the reviser surely should not have allowed such a statement to stand in 1910.

PRACTICAL TALKS ON CONTRACTING.—Being Reprints from "The Contractor" of Valuable Papers by Frank B. Gilbreth, C. A. Worden, A. O. Davidson and E. S. Hanson. Chicago, Ill.; The Contractor Publishing Co. Cloth; 5½ × 8¾ ins.; pp. 128; text illustrations. $1.50.

With the passing of the old-time contractor, whose estimates were made by main strength and whose very notable profits were the result of lack of scientific competition, there has grown up a literature on the business of contracting, which concerns itself not with the structural details of a contractor's work nor with the methods of handling and operating his equipment, but with the organization of his force and the recording of his experience for future estimating, so that the maximum of efficiency may be reached. The little book noted above is the latest of this type. It consists of a series of reprints from the pages of "The Contractor," of twelve papers by four different authors covering such subjects as office systems, liability insurance, estimating, purchasing and equipment records, operation of camps and the application of photography to contractors' records. Being by separate authors, there is no great coherence between the various papers but the intention of each is the same and the value of the whole to the contractor anxious to put his business on an orderly basis is quite apparent.

SAND-CLAY AND EARTH ROADS IN THE MIDDLE WEST.—By W. L. Spoon, C. E., Superintendent of Road Construction, Office of Public Roads. Circular No. 91, Office of Public Roads; U. S. Department of Agriculture; Logan Waller Page, Director. Washington, D. C.: Pub. Doc. Paper; 6 × 9¼ ins.; pp. 31; six illustrations in the text.

This bulletin, issued by the Office of Public Roads, describes experiments in the construction of sand-clay roads in Kansas, and discusses the different typical sand and clay deposits found throughout the Mississippi Valley. In a large portion of the states bordering the Mississippi and Lower Missouri, the surface soil is a gumbo clay which becomes a bottomless quagmire when wet. The difficulties which have been experienced in the construction of short sections of broken stone roads in these sticky clay districts are well known. The author of this pamphlet claims that by making a proper mixture of sand and clay, an excellent road may be obtained for a small fraction of the cost of macadam, and he declares that "in most cases it will prove equal, if not superior, to the more expensive macadam road." The experimental roads on this system built at Bucklin,

Dodge City and Garden City, Kans., cost at the rate of $700 to $1,200 per mile.

If sand is a valuable material for application to a clay road, even more is clay valuable for application to a sand road. Roads in the clay districts made on the natural soil are generally fairly good for at least half a year, but a sand road offers greater resistance to traction than any other road and is bad at all seasons of the year. By applying clay to such sand roads, however, a surface may be secured which will stand country traffic excellently, and the sand base provides a good foundation.

A Sweeping Condemnation of Technical and Other Higher Education.

THE UTILITY OF ALL KINDS OF HIGHER SCHOOLING.—An Investigation by R. T. Crane. Chicago, Ill.: The Author (1241 S. Canal St.). Cloth; 5¼ × 8¼ ins.; pp. 331. $1, net.

Eight years ago Part I. of this book was published in pamphlet form, with the title: "The Utility of an Academic or Classical Education for Young Men Who Have to Earn Their Own Living and Who Expect to Pursue a Commercial Life." The present volume is a reprint of that pamphlet, with additional matter of about equal amount relating to technical and special schooling.

In his earlier investigation, Mr. Crane came to the conclusion that the time-honored classical course of study in the colleges was rather an injury than a benefit as a preparation for practical life. Recently he has made investigations of schools which teach civil and electrical engineering, medicine and agriculture, and he now includes all these in the same sweeping condemnation that he formerly visited upon the classical colleges.

Most teachers in engineering schools, and in other schools, will be inclined to dismiss with disgust Mr. Crane's book, after they have glanced over a few of its pages, because of the prejudice and lack of information which are apparent all through it. We do not believe it should be so lightly set aside. Mr. Fred. W. Taylor has stated that the views expressed by Mr. Crane are very commonly held by the men in charge of large business interests. If this is true, then certainly the book deserves the careful study of the professional educator. We may go further, indeed, and say that it deserves the careful attention of every one who is interested in the important subject of higher education. Mr. Crane voices a general dissatisfaction that is undeniably felt with the work of our higher schools, and, for that matter, with the work of the lower schools as well; and even though his criticism be prejudiced, they are nevertheless worthy of attention.

Mr. Crane begins the second part of his book with a chapter on "Technical Education Applied to Manufacturing," which opens with the following sentences:

> There seems to be a belief in some quarters that technical education is valuable to manufacturing. I have given this matter much thought, and I wish to say that in my long experience in the manufacturing business I have seen no practical results coming from technically trained men, and I do not know of a case where a practical and successful manufacturer has taken any interest in technical schools.

This sentence illustrates excellently Mr. Crane's general position, as well as the carelessness with which he makes statements. He does not know of a case "where a practical and successful manufacturer has taken any interest in technical schools." In contrast with this, one has but to recall the fact that a considerable number of our most prominent technical schools have been founded by or have received large gifts from wealthy manufacturers.

Occasionally Mr. Crane appears to have some perception that he is spoiling his case by overstatement. For example, on page 165 he remarks, under the head, "Technical Schools Have Their Field":

> I admit that there is a legitimate, though limited, field for technical schools. If they would confine themselves with diligence and great discretion to accumulating the best practice of the best practical men, and preserve this information and experience, so that it might be handed down with discretion to the students, they might do considerable good.

Mr. Crane's naïve way of viewing the technical schools, and technical education generally, is shown by his evident respect for books. Witness the following:

> In no case would it be prudent for the practicing engineer to depend upon his memory for important rules and figures. The prudent man simply will go back to the authorities and there ascertain definitely what the rules and figures are before he attempts to use them.

Again he says (page 186):

> Notwithstanding the fact that the evidence shows there is no occasion for the ordinary engineer to go to a technical school, it does not appear unreasonable that he might get some benefit from schooling. But . . . what he requires are matters he could get right from books. He knows what he wants, but may not know the books; he does not need a teacher to urge him to study, and the teacher does not know anything but that contained in the books.

Again, on page 211, he lays out a training for apprentices in electrical engineering, and says:

> During this time the boys could attend night-school as much as is necessary, and be furnished with books on the science of the different lines of electrical apparatus, books that contain only such things as the best practical men know to be essential.

It is curious to note Mr. Crane's implicit faith in books, notwithstanding his contempt for education.

Mr. Crane's opinion of the average engineering student may be gleaned from the following:

> Probably not more than one man in a thousand, even among those who go to technical schools, has any unusual amount of brains. As it costs probably $5,000 to give a boy a technical-school education, and not more than one in a thousand who attends these schools has the brain capacity to make an eminent engineer, it will be seen that the education of the one person who is really benefited by the schools costs $5,000,000.

Mr. Crane pays a high tribute to the work of the early engineers. He mentions particularly Smeaton, Brindley, Rennie, Telford and Brunel among Englishmen, and James Geddes, Benjamin Wright and John B. Jervis among American engineers. Because the engineers of that day achieved greatness without technical education, he argues that technical education is wholly unnecessary for engineers at the present day. He meets the argument that engineering has grown more complicated as follows:

> Admitting that the problems of to-day are greater, they would embody the same principles as those of an earlier day, and practically all of them were solved before we had any technical schools. Once we have mastered the construction of a bridge to carry a 50-ton locomotive, a bridge to bear a 100-ton locomotive presents no new problems.

We could continue indefinitely, illustrations like the above, which show Mr. Crane's lack of knowledge of the subject he attempts to discuss; but it is of more value, we believe, to call attention to his criticisms which have real force. There is reason, without doubt, in his condemnation of the medical colleges which grant degrees to students with only a smattering of a medical education. His argument that an undue proportion of the money now applied to education is spent on high schools, universities and colleges, while the common schools are neglected is worth serious attention. One of the best things that a book can accomplish for its reader is to set him to thinking. From that point of view, Mr. Crane's book is emphatically successful. We wish that every teacher in the high schools and colleges and particularly every pupil in these institutions would spend an hour or two over Mr. Crane's book.

If some of the students who read it are led to the resolve to use their four years in college so profitably that Mr. Crane's criticisms shall be proved false so far as they are concerned, the book will certainly not have been written in vain.

THE ESSENTIALS OF LETTERING.—A Manual for Students and Designers. By Thomas E. French and Robert Meikeljohn. Second edition. Columbus, O.: Varsity Supply Co. Cloth; 9 × 6¼ ins.; pp. 72; 74 illustrations in the text. $1.

Lettering for engineering and architectural drawings and also for use in the art of design is described briefly in this manual. Chapter I. gives a condensed outline of the history of the development of the principal types of alphabet. The remainder of the first half of the book is devoted to lettering suitable for maps, working drawings, etc. Specimen alphabets are given with instructions as to the proper sequence and direction of the several strokes in each letter. Proper composition of letters into words and of words into titles is also discussed.

The last half of the book takes up the subject of lettering for "design." The "designer" (in the artistic sense) uses lettering not only to convey information but "for its own inherent beauty of line and composition." The alphabets shown in this latter part of the book would be classified by the average mechanical draftsman as "fancy."

Chapter IX. is a bibliography of books on both fancy and plain lettering for those who wish more than an introduction to the subject.

This manual is commendable for the amount of useful information it presents in condensed form. It will be much appreciated by those who wish to get at the essentials of lettering, with the least possible effort.

DIAGRAMS FOR DESIGNING REINFORCED CONCRETE STRUCTURES.—Including Digrams for Reactions and Strengths of Steel Beams. By G. F. Dodge. New York and Chicago: The Myron C. Clark Publishing Co. London, England: E. & F. N. Spon, Ltd. Boards; 14½ × 12¾ ins.; pp. 104; 43 diagrams in the text. $4.

This is by far the largest and most pretentious of the many sets of diagrams and tables for the designing of reinforced concrete which have been published in the past few years. It is 13 × 15 ins. in size, contains some 104 thick and heavily coated pages and weighs nearly 4 lbs., so that it needs must be a fixture of the designing desk. There are ten diagrams covering the design of slabs and of prismatic and T-beams, under the straight line law for working loads with four values of the ratio of moduli of elasticity of steel and concrete; two diagrams for compressive reinforcement; one diagram for shear stress; three for columns, with both straight and hooped reinforcement; five for slabs and beams under ultimate loads with the parabolic law of stress change; and one each for deflection, impact, weights and volumes of beams, slabs and columns, metric conversion and reactions and strength of steel beams. This makes in all 26 diagrams each reproduced on a full-size sheet of the book in a very clear manner.

According to his preface the author has endeavored to cover in one book all cases of design in reinforced concrete and it must be admitted that the general application of his method is evident. But it is a monstrous big book that he has produced which must contain much that the ordinary designer will not need in his work.

PUBLIC SERVICE COMMISSION FOR THE SECOND DISTRICT OF THE STATE OF NEW YORK.—Report for the Year Ending Dec. 31, 1908. (Frank W. Stevens, Chairman.) In three volumes. Albany, N. Y.: Pub. Doc. Cloth; two maps in separate envelope, showing steam and street railways of the State.
Vol. I.: Report and Appendices A to O, inclusive. 5¾ × 9¼ ins.; pp. 933.
Vol. II.: Uniform Systems of Accounts. 5¾ × 9¼ ins.; pp. 716.
Vol. III.: Abstracts of Reports of Corporations. 9½ × 12¼ ins.; pp. 318.

The magnitude and growing importance of the work of the Public Service Commission for the Second District of New York State is shown in part by the number and size of the volumes required for the annual report. One of the smaller volumes noted above gives the comparatively brief general report of the Commission, and also, in various appendixes, the numerous orders and tariffs issued during the year, together with the report of the Supervisor of Equipment and reports of inspections of electric and steam railroads. The companion volume is devoted to a detailed exposition of uniform systems of accounts for various corporations under the supervision of the Commission, which systems have been devised by the Commission and its agents. These systems cover accounts for railroad, street railroad, electric and gas corporations. For all save the railroad corporations, different systems of accounts are provided for corporations with varying amounts of gross operating revenue. The volume should be helpful to all who are engaged in supervising public utility corporations or making a careful study of such supervision.

STATE DEPARTMENT OF HEALTH (New York).—Annual Report for the Year Ending Dec. 31, 1908. (Eugene H. Porter, M. D., Commissioner.) In two volumes. Albany, N. Y.: Pub. Doc. Cloth; 5½ × 9 ins.; pp. 904 and 892; numerous folding and other plates, and text illustrations, and four folding maps in pocket of Vol. II.

The first of these volumes is devoted to the general report of the Department and to the re-

ports of various divisions other than that of engineering. The volume contains information regarding various municipal water-supplies and a considerable number of water analyses; also, reports on investigations of typhoid fever, and a number of papers, with accompanying discussion, presented before the annual conference of sanitary officers.

Vol. II. is wholly occupied with the doings and findings of the Sanitary Engineering Division, which includes Mr. Theodore Horton, M. Am. Soc. C. E., as chief engineer, and four engineering and one special assistants, and two inspectors. Over 200 pages of the volume are given up to sewage disposal. General examinations of public water-supplies, rules for the protection of such supplies and inspections to ascertain whether or not such rules have been violated, together with special investigations of unfiltered supplies and of water-purification plants, occupy nearly 200 additional pages of the report. A total of 33 places were visited for the purpose of inspecting water-purification plants reported as being in existence. In a few cases, no plants were found, and some of those found and described were very crude. The descriptions given contain a large amount of interesting and valuable information.

Next in order come reports on investigation of complaints relating to stream pollution and to other nuisances. There are also included in the volume reports on inspections of rendering plants, and on various special investigations, including sanitary investigations of a number of cities and summer resorts, and also of shell-fish grounds. A report of a half-dozen pages or so deals with the proposed Passaic Valley sewer.

Still Another Book on Illumination.

ILLUMINATION AND PHOTOMETRY.—By William Elgin Wickenden, Assoc. M. Am. Inst. E. E., Assistant Professor of Electrical Engineering, Massachusetts Institute of Technology. New York: McGraw-Hill Book Co. Cloth; 6 × 9½ ins.; pp. 195; 116 illustrations in the text. $2, net.

Prof. Wickenden states in the preface to this volume that (1) he has aimed to prepare a text-book for engineering schools, and that (2) he has given preference to methods of rational analysis rather than to descriptions and accounts of present practice. These opening statements should make a reader "pause and consider."

From the number and quality of recent treatises on illumination, one would hardly expect that a course in lighting and allied subjects would demand a new text—especially as such courses, if for undergraduates, should be brief and of secondary importance. The addition of this book illustrates the tendency of each instructor to make his students read a text closely paralleled by his lecture and laboratory courses. The number of persons is increasing who feel that breadth of training is better induced by letting the student gather ideas of practice and applied science from many viewpoints. If Prof. Wickenden's book is used mostly outside his own institution and in connection with the other similar books, greater service will be done all around in training engineers than if its use is largely in the author's own classes, supposing an equal number of copies distributed in each case.

A careful reading of the book, moreover, leads one to the belief that the second prefatory remark was written before the parts of the book were assembled so that it could be viewed as a whole. For instance, there are 140 pages, out of 190, of what may fairly be called discussions and descriptions of "present practice"—including standard light sources, photometric devices, commercial electric and gas lamps, shades, technical and artistic demands in illumination schemes, tables and charts to facilitate computations and estimates. Physical and physiological phenomena equally share about 20 pages, and what may be strictly called "rational analyses" (concepts, photometric quantities, calculation of illumination) occupy 30 pages. This result might have been expected from the necessarily indefinite phenomena of vision and the empirical attack of many lighting problems.

The book, viewed as a whole, gives a concise summary of the theory and practice of illuminating engineering. In general arrangement and content the book is admirable, though not novel. It is one of the best on the subject and in it are many observations which a photometric operator unthinkingly realizes, but which a student could hardly be expected to know. The phenomena of light production and of vision, with discussions of concepts, terminology, etc., form the first part of the book. These are followed by the descriptions of photometric apparatus—for laboratory and field work—and this section in turn is followed by descriptions of incandescent electric lamps, arc and vacuum-tube lamps and apparatus for gas lighting. The rest of the book takes up shades, globes, reflectors, the calculation of illumination, engineering and esthetic considerations entering into the lighting of interiors and exteriors.

Anyone who carefully follows this book will surely get a comprehensive view of the science and arts of photometry and illumination, but at several points the author has failed to grasp opportunities for presenting certain concepts in ways which might have made his book most helpful to students. For instance, on page three one reads:

> Light produced by black body incandescence is therefore of inherently low efficiency and is in reality a by-product of the production of radiant heat.

What a chance here to show in a word that energy is not radiated as heat, and appears as heat only when the radiations are intercepted! Again we read, on page five:

> The search for a more efficient source of luminescence is in an empirical stage.

That is hardly the most instructive view. Was not the search for a carbon filament of low volatile content and low vapor tension, or Dr. Auer's search, for ways of making filaments of the rare high-atomic weight metals more than empirical, or Dr. Steinmetz's search, for electrodes for alternating-current luminous arcs with which the voltage required to maintain current through the vapor of the arc stream would be equal to, or less than, the high-temperature sparking voltage. Here was a chance to impress on the students the greater utility in searching for material having certain mechanical or electrical properties which theory or accumulated data recommend rather than in tedious trial, under chance conditions, of everything the investigator can lay hands on in his blind search. In the early days of electric lighting Mr. Edison's famous experiments with every substance in his laboratories brought wonderful results. But to-day, with a better understanding of physical and chemical laws, such methods are growing more and more obsolete and the glamor attached to them, in the minds of the younger generations, must be dispelled.

On page 140 the author, in speaking of illuminating gas, states that

> dangers from the escape of gas such as asphyxiation and explosion are slight, due to the ease with which the odor of escaping gas may be recognized.

Here it would have been opportune to add a note of warning on the explosions which have occurred when persons were not around to smell the escaping unburned gases or when vent pipes permitted their hidden accumulation in flues to which other products of combustion were passed.

Nor is the author always as accurate and clear in his statements as desirable in an instruction text. For instance, on page six one reads,

> The spectra of all incandescent illuminants are continuous, i. e., all wave lengths are represented. . . . Luminescent spectra [of gases under the influence of electrical, thermal or chemical stimuli—Ed.] are discontinuous and consist of detached bands, each representing a limited group of wave lengths.

But on pages 125 and 126 one also reads, concerning the Moore vacuum-tube lamps:

> The spectrum of diffused white daylight is closely reproduced when carbon dioxide is employed.
>
> It's most noteworthy feature is the possibility of reproducing the quality and spectrum of diffused daylight, in which it stands alone among modern illuminants.

Now one may well assume that no luminescent gas can have a continuous spectrum like that of an incandescent body, such as the sun, and as the Moore tube reproduces the effect of daylight it must do so by producing red, green and blue spectrum bands which blend into the pure white.

In all the photometric work which the author discusses, little or nothing is said concerning the errors made in determining the distribution of candlepower about a lamp fitted with a shade or reflector. Such errors are particularly apt to be serious with certain types of prismatic reflectors which concentrate the beams in certain directions so that the intensity of luminous flux does not decrease according to the square of distance increase. Students are yearly completing photometric laboratory courses without an idea that such a condition of error exists. Studies of the extent of such errors are being made in a few laboratories, and it may be early to speak accurately concerning them, but their existence might well be acknowledged.

These minor criticisms should not blind a reader to the care with which the text has been framed, on the whole, and to the clean, concise expression. Teachers of electrical engineering especially will find it useful, though, perhaps, hardly necessary for the successful completion of the courses they are giving in photometry and lighting.

UTAH CONSERVATION COMMISSION.—Preliminary Report, 1909. (Jos. F. Merrill, Secy., University of Utah, Salt Lake City, Utah.) Cloth; 6 × 9½ ins.; pp. 128. Free on application.

The Utah Commission was established in accordance with a law passed by the Utah Legislature in 1909, the law specifying as the duty of the Commission "to adopt and carry out such policies and measures as will prevent waste of the natural resources of Utah." A considerable part of the book is devoted to the agricultural development of Utah. About 1,000,000 acres of the state are at present irrigated, and the possible maximum irrigable area, when all the waters of the state shall be stored and utilized, is set at 10,000,000 acres. Dry farming, however, is believed to be even more important to the future productiveness of the state than the extension of irrigation. The Commission estimates that nearly a million acres are now being cultivated by dry farming, and believes that an enormous extension of this area will be possible. The dry farms are now producing 20 bushels of wheat per acre, on an average, of a nutritive value one-tenth to one-fourth higher than wheat grown in a humid region.

Under the head of "Minerals," the Commission reviews the development of copper and the precious metals in the Bingham, Tintic, Park City and Mercur mining districts. An iron ore deposit in the Iron Springs district, amounting to some 40,000,000 tons, is described. The coal area of Utah is 13,130 square miles. The gilsonite deposits surpass in variety, purity and extent all other deposits anywhere in the world. The chapter on Timber Resources shows that 95% of the forested area is included within the national forests. One governing motive in establishing the national forests has been regulation of grazing. The following passage is worth quoting:

> Many of the national forests [in Utah] were created upon the petition of the people affected, in order to secure the regulation of grazing and protection from fire upon important watersheds, and thus check the immense damage being done by floods.
>
> Two of the best examples of this are the Manti and Fillmore forests. In the case of the former, as a result of unregulated grazing the watersheds were stripped and severe floods occurred annually early in the spring. These floods caused severe erosion and washing in some places, and in others considerable areas of agricultural land were deeply covered with material carried down from the mountains. The value of the streams for irrigation purposes was greatly decreased, owing to the fact that the melted snow in the mountains went off with a rush early in the spring, thus greatly shortening the irrigation season, and lessening the amount of late water available for that purpose.
>
> It was practically impossible to make use of the water for domestic purposes, on account of the great amount of silt and impurities held in suspension, and the befouling of the water due to the existence of too many sheep upon the headwaters of the streams. Practically the same conditions existed upon the Fillmore National Forest.

Since the creation of the national forests, according to the testimony of the settlers, conditions have steadily improved. The Manti Forest was created in 1903, and since that time the number of stock has been greatly reduced, and better methods of handling brought about. One of the first acts in the administration of the forest was to totally exclude all stock from the forks of Manti canyon; and as a result the area is now well covered with vegetation. Since stock has been kept out of the forks of Manti canyon, no serious floods have occurred.

On the other hand, in the canyons immediately north, south and east, in which stock is improperly grazed, destructive floods have followed heavy rains. During August this past summer, a great amount of rain fell over the entire area of the Manti Forest, continuing intermittently during the whole month. At this time terrific floods, carrying with them large quantities of mud and boulders, occurred in the canyons north, south and east of Manti canyon.

An Odd Treatise on Electricity.

ELECTRICITY.—By H. M. Hobart, M. Inst. C. E. A Text-Book Designed in Particular for Engineering Students. New York: D. Van Nostrand Co. Cloth; 5¼ × 8¾ ins.; pp. 207; 115 illustrations, mostly in the text, and 43 tables. $2, net.

Mr. Hobart, in writing his present treatise on electricity, has started out evidently with the idea that the older text-books, which have presented as concisely as possible the academic side of this branch of science, are now to be discarded. He says in his preface that while these old-style text-books dealt with the various topics adequately and with remarkable clearness and presented all the knowledge that had been obtained during those earlier stages of development, yet they are too full of the phenomena of the action of electric eels, frogs' legs, cat skins, lode-stones, pith balls, sealing-wax, the aurora borealis and Benjamin Franklin's kite. He holds that the present knowledge of electricity is so vast and so capable of being applied to the everyday wants of the race that it is more desirable in an elementary book to introduce those topics which illustrate, with things close at hand, the most important underlying principles of this branch of physics. His expressed aim, therefore, has been to take a few important developments of electrical engineering to serve as a nucleus about which to build up a form of expository matter. His treatment throughout shows the hand and the mind of a practising engineer rather than of a teacher. Innumerable instances are seen where his choice of words and terms differs greatly from the choice which would have been made by a physicist or a teacher and, in following the "popular will" in the use of such words and terms, he has sanctioned also popular misconceptions and indeed would pass them along to engineering students.

One is struck with the use of the terms "continuous electricity" and "alternating electricity," where it is more common to say, on this side of the ocean at least, "alternating" or "direct current." This seems to be the intended logical development of the author's definition of the term "electricity," meaning by that a form of energy. He states that "electricity" may be regarded as having three components—volts, amperes and time. He does not state, however, that the ampere is not a simple term but is a rate embodying quantity and time. Therefore, his three components of electrical energy are capable of being reduced to two—coulombs and volts—the recognized "intensity" and "extensity" or "force" and "distance" components of energy. The author's iconoclastic ideas here not only fail of useful purpose, but positively do harm in obscuring the student's need of clearly grasping the fundamental concept of energy dimensions or energy components, or energy characteristics, however one may choose to express the idea. Energy is fundamentally independent of time, and it will be regarded in many quarters as an educational sin to define electricity as energy and then to say that it has a time component.

In pursuing the use of the terms "continuous electricity" and "alternating electricity," confusion appears when the author gets to the phenomena arising from what one commonly calls "alternating currents." When the author speaks of "alternating electricity," meaning as he does alternating energy, the concept to be first grasped is that of energy received and returned—a sort of a give-and-take process on the part of the circuit connected to the source of alternating potential. The supply of energy in a circuit with alternating potential may vary in amount, may pulsate and may even actually alternate, but to give useful effects the effective, or average mean, value of the energy transformation must be greater than zero. To most readers, the author's "current of alternating electricity" will not usually mean the same as the common "alternating current of electricity."

The author starts off his treatise with the ideas of generation and conduction of electricity, and he develops the factors that enter into the resistance of a circuit to conducting a current. The approach to the complete concept of specific resistance is gradual and easily grasped. From the first, however, the American reader will find the typographical arrangement confusing, though perhaps perfectly clear to the English reader and in accordance with the British practice.

As an example of this, Table I., on page 3, may be taken. Thus the comparative resistances of different metals are shown as in the following columns:

Silver	0,92
Copper	1,00
Gold	1,38
Aluminum	1,64
Zinc	3,62
Purest iron	5,62
Platinum	6,87
Nickel	7,50
Lead	12,5
Mercury	59
Cast iron	62

To the unwarned American reader, the values seem to rise from that of silver to the nickel, while those of lead, mercury and cast iron would seem to decrease again. Actually the last four values instead of being 7.5, 12.5, 59.0 and 62.0 are 750, 1,250, 5,900 and 6,200, respectively. Throughout the book also the use of the comma in place of the decimal point is maintained.

The treatment of the magnetic field opens well, but soon becomes quite empirical. Flatly approximate and working statements of how to find the density of magnetic field—number of hypothetical lines of force—at different points in the neighborhood of various arrangements of current-carrying conductors are made, and series of numerical results are tabulated. This style may lead a student along a short, easy path to the designing of electro-magnetic apparatus, but it gives him no mental picture of the cause of the phenomena which his apparatus is to employ. It is the correspondence-school style of teaching the "how" and not the "why" of things. Most teachers of electrical engineering in regular schools, we believe, still prefer to have their students as well grounded as possible in the physics of electricity, if one may be allowed to use that expression, in order that they may get an understanding of actions and exact laws at the start from which working statements and approximate data may be derived later and by the student himself. The tendency for this earlier technical education seems to be towards the development of the understanding more than of the memory, and Mr. Hobart's methods are not conducive to that end.

The one part of the book of great interest to engineers and teachers is the final section on insulating materials. It is essentially a discussion of the law derived by one Baur, that the potential required to break down a sample of insulating material is definite for each material and proportional to the two-thirds power of the thickness. The results from investigations made in all parts of the world are discussed with reference to their bearing on, and departure from, this proposition. The requirements for insulation in electric-power apparatus are always kept in mind in these discussions. One may well wonder why such an advanced subject (commonly regarded as in the realms of practice into which many believe a student should be allowed to wander only after the essential facts and principles are thoroughly understood) should occupy a seventh of an introduction to the study of the elements of electricity and magnetism. The author's answer is his first paragraph of this section:

In setting forth the principles underlying electrical phenomena, the discussion of the properties of conducting and magnetic materials is usually given far more prominence than is allotted to the discussion of the properties of insulating materials. It is not at all improbable that in the near future it will be widely recognized that, of the three classes, insulating materials will rank as being of fully as great importance as the other two classes of materials.

Mosquitoes and Other Insect Disease-Germ Hosts and Spreaders.

MOSQUITO OR MAN? The Conquest of the Tropical World.—By Sir Rubert W. Boyce, M. B., F. R. S. New York: E. P. Dutton & Co. Cloth; 6 × 9 ins.; pp. 267; 44 illustrations. $3.50, net.

The author of this valuable work has brought together a large amount of instructive information regarding the relation of the mosquito to various diseases which he helps to transmit, and also in relation to some of the other diseases, in the dissemination of which insects of one kind or another are intermediary agents.

He begins with a sketch of "the Tropical Medicine Movement in England," which led to the foundation of the Liverpool and the London schools for the study of those parasite diseases peculiar to the tropics, but which diseases are by no means confined to those regions, although, like malaria, they flourish best in hot, moist countries. This first chapter is concluded by the following paragraph, which will serve in some measure to give an idea of the importance both of the book and the subject with which it deals.

I will in the following pages bring forward the bedrock facts upon which I base my assertion that in the study of tropical medicine—that is to say, by the study of a wider medicine as distinguished from the parochial, local or older form—nations possess a force which above all others can wrest vast provinces from the sway of the insect pests which, though minute in size, yet in their aggregate mass have defied and hurled back man when he has ventured into their domain, or completely wiped out those who tried to gain a foothold. The narrative would appear more like a fairy tale were it not based upon easily accessible reports and figures.

The author next takes up the growth of sanitation in tropics, and shows how sanitary conditions have been remarkably improved with the construction of better houses, the introduction of pure water, sewerage, drainage, etc.

Another brief chapter is headed "Miasm, Tradition and Prejudice," and shows how slow the public has been to get away from the notion that putrifying organic matter in night air, gravel ballast in ships from foreign ports and the like are responsible for malaria, yellow fever and other similar diseases.

In a number of succeeding chapters the author gives interesting accounts of the discoveries and discoverers of the fact that the mosquito is an essential factor in the continuance and spread of both malarial and yellow fever. Campaigns against both of these diseases and the mosquitoes responsible for their prevalence, as carried on in many parts of the world, are summarized, including the important work in Cuba, New Orleans and the Panama Canal Zone. These summaries are accompanied by reprints of printed matter used in the campaigns and descriptions of some of the specific measures carried out.

Having disposed of malaria and yellow fever, the author next takes up sleeping sickness, for the spread of which the tsetse fly is responsible. This disease spread over a large part of Central Africa a few years ago, and it is believed was the cause of the death of no less than 200,000 people in the Uganda Protectorate alone. Studies made by Dutton, Kleine, Bruce and others showed that the tsetse fly "acts as a true host" to a parasite which has been named trypanosome, "just as the anophelines do to the parasite of malaria; in other words, the fly appears necessary to the propagation of the disease." To prevent the spread of the disease it is necessary to exterminate the carrier exactly in the same way as in campaigns against malaria, yellow fever and the plague. We quote three short paragraphs as follows:

The tsetse fly, like the common house fly and like the mosquito, has its two phases—the adult winged form and the larval form. It can be attacked at both stages, whichever is most practical or most convenient.

In the first place, observations have shown that the

breeding place of the fly is the strip of ground bush along the rivers; a strip about 30 yards wide extending from the river bank is the usual breeding zone; breeding appears not to extend to any marked degree beyond this distance.

The larval or pupa stage evidently requires a certain amount of humidity and shade, and requires to be protected from the direct sun rays, and hence the fly chooses the damp shaded humus of the bush in which to deposit her pupae. Therefore, as a first step in prophylaxis, it is necessary to destroy the ground bush, to burn it for a depth of about 30 yards from the river-bank.

Protection of man from this fly involves the wearing of plenty of white clothing, the use of screens and other measures similar to those adopted against the mosquitos.

The same chapter gives brief consideration to the common house fly, which, as has been made known during the past few years, is responsible for the spread of a large amount of typhoid fever; but what is not so well known here, it also causes the spread of cholera, tuberculosis and "the diarrhea prevalent in towns in summer time." On this account the author suggests that instead of calling the common house fly the "typhoid fly," as proposed by Dr. L. O. Howard, of Washington, D. C., it might more properly be named the "septic fly." Mention should also be made of the fact that this common pest is largely responsible for "the dissemination of the common ophthalmia present among the poor people" of Egypt. Rules for fighting flies are given.

The next chapter is headed "Ankylostomiasis: Dirt Contamination." This disease, which has gone under such various names as tunnel disease, brickmakers' disease, earth eaters' disease, tunnel anaemia and ground itch, has come prominently to the attention of the American public during the last few months as the hook worm disease. Its spread is due to intestinal worms and their eggs, and may be prevented by the observance of most ordinary sanitary precautions.

After a short chapter on Malta fever, "a bacterial parasite disease transmitted to man chiefly by the milk of goats suffering" from the same disease, the author takes up the bubonic plague, the insect host of which is a flea which has a special predilection for rats. The campaign against the plague is given the name of "deratization." Tick fever, leprosy and tuberculosis are given a brief space in this chapter.

The volume concludes with an appendix which gives anti-mosquito laws adopted in many parts of the world, and with a list of "commissions and expeditions sent to the tropics to study tropical diseases."

It may be seen from the outline which we have given of the contents of this book that it is really much broader than its title indicates. Although we have not taken the space to bring the fact out very fully, yet the book as a whole makes it plain why the merchants of Liverpool and of London have been willing to contribute so liberally to the support of the two schools of tropical medicine which bear the names of those cities. The suppression of these various tropical diseases has already done much to ameliorate the conditions which for centuries past have made commercial ventures in many of the best trading ports of the world extremely risky from point of health and life to all who take part in them. Military operations also, as well as the conduct of the colonial government of various countries, have been accompanied by immense loss of life due to these many insect-born diseases. The campaign for their extermination may now be said to be well begun, although a vast amount of work yet remains to be done in many quarters of the world before the white man, to say nothing of the vast numbers of natives, will be freed from constant danger of dessimation or worse from these diseases.

It should be understood in conclusion that the book contains much of suggestion to people residing in a large proportion of the United States for parts of the country are always liable to an invasion of yellow fever unless rigid precautions against the disease are taken, while in large areas malaria and anylostomiasis, or the hook worm disease, claim their thousands of sufferers yearly. In addition, extensive sections which are in almost no danger from yellow fever and have

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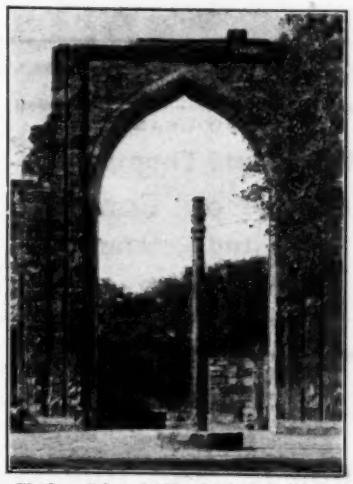

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little to fear from malaria may learn from this book how to exterminate the "harmless" mosquito. Finally, the book deals with the ordinary but dangerous house fly, which is ever ready to carry typhoid infection in all parts of the country, if given a chance to do so.

A French Work on the Health of Cities.

Reviewed by GEORGE C. WHIPPLE,* M. Am. Soc. C. E.

HYGIENE ET SALUBRITE GENERALES DES COLLECTITES RURALE ET URBAINE.—By E. Macé and Ed. Imbeaux. Paris, France: J. B. Balliere et Fils. Paper; 9¾ × 6¾ ins.; pp. 354.

This is a comprehensive treatise on the general subject of the health of cities. Of the authors, Prof. E. Macé is a Member of the Consell Superieur d'hygiène de France and Mr. Ed. Imbeaux is Directeur de Service Municipal de Nancy, the latter being well known to American engineers through his writings on waterworks subjects. Although written, naturally, from the French standpoint, the book contains numerous references to conditions in America, England, Germany and other European countries so that comparison between them is made easy.

The book is divided into two parts. The first part treats of the general causes of unsanitary conditions in cities and their effect upon the public health. Among the general topics taken up are population and growth of cities, vital statistics, and the various environmental conditions of urban life. Then follow more detailed references to the subjects of transportation, public streets, habitation, food supplies, water-supplies and disposal of wastes of all kinds, with numerous tables of statistics. The section devoted to trade wastes and the analysis of waste liquors from various industrial establishments is particularly interesting. So also are the analyses of sewage in various cities.

The second part, treating of remedial measures and sanitary utilities, is likely to be found most interesting to engineers. The drainage of the soil, protection of travelers against accident, street cleaning, ventilation of buildings, inspection of food, purification of water, disposal of sewage and trade wastes, the smoke nuisance and protection against accidents in industrial establishments, are well set forth. These subjects are not treated in detail but statistics are given showing the progress made in different countries along the line mentioned.

Water-supply and sewerage statistics for France, Germany, Belgium, England and other countries show the general status of such undertakings by source and mode of supply, whether purification plants are in use, number of cities without water-supply or sewerage, etc. The French and German statistics are recent but the statistics for America are as old as 1902.

There are other books on general sanitation just as valuable as this, but hardly another so wide in geographical scope. For this reason American engineers will find it a valuable book of reference.

The Public Milk Supply.

THE PRODUCTION AND HANDLING OF CLEAN MILK.—Including Practical Milk Inspection, by Kenelm Winslow, M. D., Author of a text-book on Veterinary Materia Medica and Therapeutics, Chairman of the Committee on Milk of the Washington State Medical Association, etc.; and Essentials of Milk Bacteriology, by H. W. Hill, M. D., Minnesota State Board of Health Laboratories of the American Public Health Association. New York: William R. Jenkins Co. Cloth; 6¼ × 9¾ ins.; pp. 367; 102 illustrations, partly in the text. $3.25, postpaid.

A number of books on milk for the supply of cities and towns have been published within the past few years, but none that we have seen is so comprehensive as this one. The earlier books have dealt with the subject almost wholly from the viewpoint of the health officer. This one is written largely from that point of view, but it also takes up the subject in many of its phases which more particularly concern the producer and the distributer of milk. It is true that many of these phases have some bearing upon milk sanitation, but most of them relate primarily to

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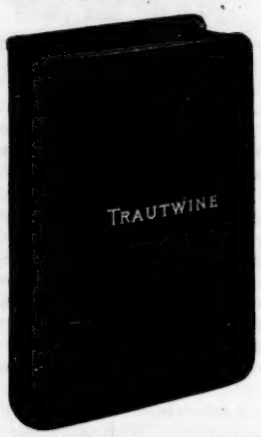

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economy and convenience of production and distribution.

The volume opens with some 40 pages of discussion of the general relations of bacteria to milk. It then takes up the composition of milk and cream and of their products, the feeding, housing and general care of dairy cows, and the handling of milk and cream. A chapter is devoted to the "Cost of Producing and Distributing Clean Milk." This is one of the most valuable and timely chapters in the book, and it is a pity that it cannot be read and appreciated by milk consumers in order that they may understand why higher prices are justified for clean than for dirty milk. Milk distribution and milk inspection on behalf of cities are next discussed.

A notable feature of the book is Dr. Hill's contribution to the bacteriology of the subject. Much detailed information is given in this section. An appendix deals with breeds of dairy cows in relation to milk production, records of the amount of milk produced by individual cows, plans and details of barns and milk rooms, milking machines, dairy accounting, and various related subjects.

Mention should be made of reprints of various rules and regulations, forms, etc., governing the inspection of dairies and the distribution and sale of milk.

The usefulness of the volume as originally prepared appears to have been materially increased by the changes in the present edition, and the work promises to rank high among those already available for the use of health officers and veterinary and other inspectors, and particularly for milk producers and distributers who wish to keep fully abreast of the times, both as regards the sanitation and economics of supplying the public with milk. Interest is added to the volume, owing to the fact that the author draws considerably from conditions prevailing in Seattle, Wash., which city, we believe, is taking a leading place in the attention which it has given to the character of the public milk supply.

A German Book on Locomotives.

Reviewed by W. F. KIESEL, Jr.,* M. Am. Soc. M. E.

HANDBUCH ZUM ENTWERFEN REGELSPURIGER DAMPF-LOKOMOTIVEN.—By Georg Lotter. Munich and Berlin, Germany: R. Oldenbourg. Cloth; 5¼ × 8½ ins.; pp. 266; 136 illustrations in the text. 8 marks; American price, $3.20.

The purpose of this book is to provide a general method of procedure for determining the essential features of a steam locomotive to suit given road requirements, and to aid in the selection of the most suitable cylinder dimensions, heating surface, grate surface, rigid wheel base, kind of trucks, etc. Although it is principally for the use of students of steam locomotives, it contains much information published in recent years in the engineering periodicals of Germany, France and England, but rearranged in proper sequence, which makes it of great interest to those who are actively engaged in designing locomotives.

The first chapter treats of train and wheel loads, radius of curvature, trip lengths, fuel, and other topics. Next the author takes up the determination of train resistance, drawbar power, heating surface, and in general the dimensions and arrangements of all the various parts of the locomotive.

Under valve motion he discusses port areas and in the last chapter gives a method of checking, adjusting and correcting the separate calculated features to obtain the desired results.

On pages 32 to 123, are tabulations of 193 modern European locomotives, under 45 headings, covering all the principal features and governing ratios. These represent successful European designs, and are intended as a guide for selection of proper combinations.

Chapter IV., after general remarks on wheel arrangements, spring rigging and tenders, presents a very interesting dissertation on the means employed to produce smooth running on tangents and curves, and a description of a very simple geometric method of studying the action of the

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X Buildings	54
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The formulas given throughout this work are naturally based on the metric system, and indicate the extreme range between which these values have been used. Drawings representing design have been avoided throughout the book, and where illustrations are used they occur only in diagrammatic form. A tabulation of abbreviations used throughout the whole book is appended. This tabulation is very useful, especially to those who are not very familiar with expressions in vogue in German technical books.

The book is what the title implies, merely a handbook, treating of essential features and formulas, no attempt being made to elaborate on any one subject, except that of smooth running on tangents and curves, which in other textbooks is not fully treated, and which at the present time is being more fully studied.

Railway Signaling.

RAILWAY SIGNALING IN THEORY AND PRACTICE.—By James Brandt Latimer, Signal Engineer, Chicago, Burlington & Quincy R. R. Chicago, Ill.: Mackenzie-Klink Publishing Co. Cloth; 5¼ × 8 ins.; pp. 420; 140 illustrations in the text. $2.50.

"An elementary text-book" on railway signaling, the author calls this book in his preface. His characterization is accurate, but modest. The book can be understood by anyone, and in so far it is elementary. But it is not restricted to first principles, or to the simpler forms of apparatus. On the contrary it enters quite deeply into the details of most of the systems and mechanisms employed, and sets forth the intricacies of interlocking with remarkable effectiveness.

One restriction which might well have been indicated is that the book is concerned primarily with interlocking. It is weak on automatic signaling, and for that matter on line signaling generally. Possibly this fact expresses either the author's idea of the relative importance of line signaling and interlocking, or his idea of their relative need for explanation. It is true, of course, that there is much more of mechanism to explain in interlocking than in simple signaling. But this cannot alter the fact that with regard to both avoiding accident and moving traffic the signals on the open line are more important than those at junctions, crossings and other breaks. The subject merits a separate book, as detailed as the present treatment of interlocking, or perhaps even more so.

Irrespective of this, the author is to be congratulated on his work, and the reader who desires to learn more of the field of duty of the signal engineer may be strongly advised to read this book. Whatever minor criticisms might be made of the text, such as that the explanations at times go too far in their attempt at clearness and become over-involved, cannot materially affect its usefulness to the student.

SPECIAL LIBRARIES.—Bulletin published by the Special Libraries Association, 54 Lafayette St., New York. Paper; 7 × 10 ins.; pp. 8.

The special movement recently started to secure cooperation and give assistance to special libraries is being represented by a bulletin devoted to that purpose, of which this is the second number. There are given in the present issue bibliographies of public utility valuations, insurance notes and references, technology notes, etc.

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AMERICAN INSTITUTE OF ARCHITECTS.—Proceedings of the Annual Convention Held at Washington, D. C., Dec. 14-16, 1909. Washington, D. C.: The Institute (Glenn Brown, Editor, The Octagon). Stiff paper; 7 × 9¾ ins.; pp. 163; one plate.

AN ANALYSIS OF THE BEARING UPON WATER WORKS MANAGEMENT OF THE U. S. SUPREME COURT DECISIONS.—In the Knoxville Water Co. and Consolidated Gas Co. Cases. Presented before the Pennsylvania Water Works Association on Oct. 21, 1909, by Mr. Leonard Metcalf, C. E., Boston, Mass. Paper; 6 × 9 ins.; pp. 22.

BRIDGE AND STRUCTURAL DESIGN.—By W. Chase Thomson, Assistant Engineer, Dominion Bridge Co., Montreal, Canada. (Second edition.) New York: The Engineering News Publishing Co. London, England: Archibald, Constable & Co., Ltd. Cloth; 6 × 9½ ins.; pp. 192; 82 illustrations, mostly in the text, and 12 tables. $2, net.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.

No. 407: Geology and Ore Deposits of the Bullfrog District, Nevada. By F. L. Ransome, W. H. Emmons and G. H. Garrey. Pp. 130; 14 plates (1 in pocket) and 20 text figures.

No. 419: Analyses of Rocks and Minerals from the Laboratory of the United States Geological Survey, 1880 to 1908. Tabulated by F. W. Clarke, Chief Chemist. Pp. 323.

COAST AND GEODETIC SURVEY.—Report of the Superintendent, Showing the Progress of the Work from July 1, 1908, to June 30, 1909. (O. H. Tittmann, Superintendent.) Washington, D. C.: Pub. Doc. Cloth; 9 × 11½ ins.; pp. 184; nine plates (in pocket) and four text figures.

COMMISSIONER OF HIGHWAYS (Maine).—Annual Report for the Year 1909. (Paul D. Sargent, Commissioner.) Augusta, Me.: Pub. Doc. Cloth; 5½ × 9¼ ins.; pp. 155; folding and other plates.

THE COPPER HANDBOOK.—A Manual of the Copper Industry of the World. Vol. IX. Compiled and Published by Horace J. Stevens, Houghton, Mich. Cloth; 5¾ × 9 ins.; pp. 1628. $5.

DIRECTOR OF FORESTRY (Philippine Islands).—Annual Report for the Period July 1, 1908, to June 30, 1909. Major George P. Ahern, Director of Forestry. Manila, P. I.: Pub. Doc. Paper; 6 × 9¼ ins.; pp. 20.

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